Towards an Open System for Multimedia Mobile Phone Exchange: Adaptation Architecture

Saighi Asma[1], Nacira Ghoualmi-Zine[2], Philipe Roose [3]
[1]pgasma_saighi@yahoo.fr, [2] ghoualmi@yahoo.fr,
[3]Philippe.Roose@iutbayonne.univ-pau.fr

[1,2]Univercité Badji Mokhtar, Computer sciences departement
[3] Université Pau, IUT Bayonne, Computer sciences departement

Abstract. Ubiquitous environment can include heterogeneous terminals that haven't the same characteristics. Exchange multimedia data using heterogeneous terminals requires an adaptation of contents or other types of adaptation. In this paper we present a state of the art as: related work in term of approaches followed by a comparative study, comparative study of five existing adaptation architectures. On the second hand we present our architecture based on Client/Intermediary/Server model. So, we distinguish four main parts: multimedia client sender and multimedia client receiver, server with descriptors of environment, and proxy as a web services. This investigation aims to conceive an open system that integrates heterogeneous mobile phones. This open architecture aims to improve Qos between multimedia sender and multimedia receiver. Our proposed architecture allows multimedia clients to deliver multimedia content according to the mobile phone's specification receiver. As study case, we present a specification of some mobile phones: Nokia 2610, Samsung X640, Sony Ericsson K320, Siemens CX65 and Nokia N93i with four illustrative adaptation scenarios.

Key words: Open system, Multimedia content adaptation, proxy, mobile phone, multimedia client.

1 Introduction

Currently, a lot of different end multimedia client's devices (mobile phones in our case) are heterogeneous. So, hardware and software capacities are heterogeneous and some times limited. End user devices features have different capabilities in terms of memory size, display size, or supported formats. However, rendering multimedia content in such an environment remains challenging, because the content itself is heterogeneous in terms of encoding. For instance, a video can be encoded in different formats such as 3gpp, MPEG-4, or WMV, using different encoder settings such as spatial and

temporal resolution, or bit rate. These limitations require an adaptation of contents or other type of adaptation. Therefore, a lot of research works where proposed in literature. Among the existing architectures, we find: ISIS **[1]** that follows the client/server model; NAC **[2]** is based in Client/Intermediary(s)/Server model. There are other architectures based on P2P model like PAAM **[3]**. DCAF **[4]** architecture is based on content adaptation services developed externally to make content transformations. The main objective of our research is to bring a solution for the multimedia client sender to deliver any multimedia document without getting an echo message due to the incapacity of the multimedia client receiver mobile phone to support the sent multimedia document. In other term, our proposed architecture aims to adapt multimedia document sent by a multimedia mobile phone before being delivered to the multimedia mobile phone receiver. Generally, the existing adaptation architectures treat multimedia data sent from a server machine to a client device but in our architecture the adaptation treatment is applied to the multimedia data sent from a multimedia client to other multimedia client and this is how our proposed architecture advances the state of the art. This paper is organized as follow, in section two we compare the existing adaptation multimedia approaches and we compare some existing multimedia adaptation architectures. Section three presents the proposed architecture, its aim and components. Section five presents studies cases using adaptation scenarios with mobile phone types.

2 Comparative studies

We present in this section comparative study between adaptation approaches in Table.1 and a comparative study between five existing architectures in Table. 2.

Table 1. Comparative study between the existing adaptation approaches.

Approach	Decision make and adaptation	Advantages	Disadvantages
Centered server [5]	In the level of the server	+The author formulates advices or constrains in the adaptation. +Implementation of dynamic and static adaptation mechanisms.	-The provider integrates adaptation mechanisms. -Calculation charge in the server.
Centered client [6]	In the client level by two methods: content selection or ad hoc transformation.	+For simple problematic.	-Badly adapted to the situations when network constrains are difficult. -Not practice.
Centered proxy [7]	In an intermediary nod: proxy	+Put results in hide. +The calculation charge is in the le proxy. +Disposes of a global view about the environment.	-bad scalability -Security problem. -adaptation tools are brought to evaluate.

Table 2. Comparative study between five existing adaptation architectures.

Architecture	Goal	Proxy	Adaptation	Profiles managements
Adaptation architecture of multimedia application by mobile code [8]	Adaptation of a distributed multimedia application by a mobile code	In the proxy site is deployed an adaptation mobile agent.	-A video is transmitted from a web site to the client. -The video passes by the proxy. -An adaptation agents are deployed in the proxy and modify the video flow.	Not specified
A generic Architecture for providing adaptable multimedia services [9]	Architecture that antiques Simultaneously the service logic adaptation using components and the adaptation of the multimedia flow.	The proxy is a service manager.	-The supervision module detects the change. -The manager determines the adaptation actions. - The service manager sends the downloading request of the adapted version.	Profile base
NAC [2]	Assures in heterogeneous environment a transmission of the adapted content with negotiation.	Communication Proxy oriented negotiation.	-ANM establishes an adaptation graph. - Static Adaptation. -Parameter of dynamic Adaptation. -DynamicAdaptation during the execution.	Profile repository
PAAM [3]	Every participant must be consummator, provider or adaptator. PAAM Inspires largely from **[9]**	There is no proxy	-To recuperate information relative to the user and to the composed document. -To decide the adaptation to apply and search the adaptators. -To instantiate adaptation graph.	User context manager.
DCAF [4]	Architecture oriented multimedia adaptation services in a pervasive environment to resolve the le interoperability problem, the flexibility and scalability	-Content proxy. -Local proxy. -Adaptation service proxy.	-Based on tierce adaptation services. -Introduce a directory of the adaptation services (ASR). -Assures adaptation of the web services available implemented apart from of DCAF. -Ontology was developed for describing the adaptation service.	CPR (Context Profile Repository)

3 Proposed architecture

The Architecture proposed in this paper is illustrated in the **figure 1**. This architecture is based upon the Client/Intermediary/Server model. This open architecture aims to improve the flexibility and the adaptability of service (Qos) between multimedia sender and multimedia receiver. Our proposed architecture allows multimedia clients to deliver multimedia content according to the mobile phone's specification receiver. It integrates heterogeneous mobile phones and provides an adaptation service for them in transparent manner.

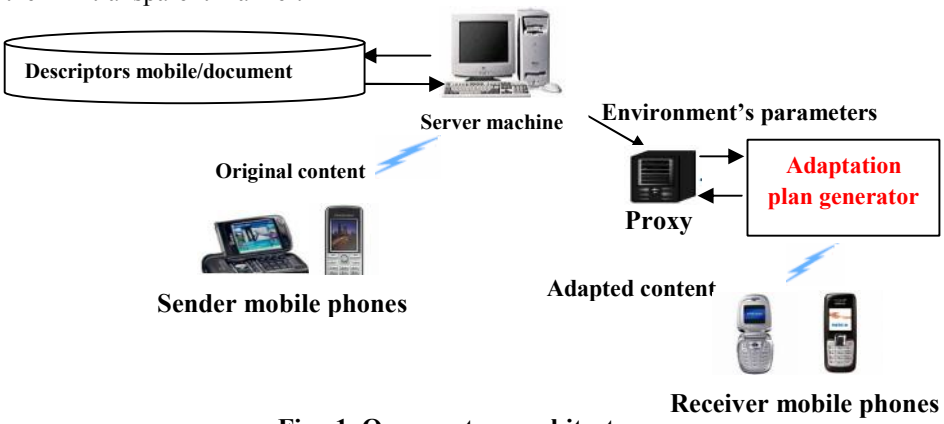

Fig. 1. Open system architecture

3.1 Components of the architecture

3.1.1 Multimedia client

There are two types of multimedia clients: multimedia client sender and multimedia client receiver.

3.1.2 Server

The server has descriptors structured as data base. Each multimedia phone has different characteristics (identifier, etc). The descriptor of the multimedia document contains the original multimedia data received from the multimedia client sender. As known, the server supports all kinds of multimedia data. Therefore, we suppose that each sent message from the multimedia client sender will pass directly and transparently to the server. Then, server selects from this message all environment's parameters: parameters of multimedia client receiver mobile phone characteristics such as screen display, supported contents and multimedia content parameters like format, size, image dimension etc. After collecting environment parameters, server checks them in the descriptors. If these descriptors don't exist, it stores them.

3.1.3 Proxy

Proxy constitutes the core of our architecture, it assists the server as a web services with its two modules: decision module and adaptation module. Figure 2, presents the behavior of the proxy. Because the success of the adaptation depends to the quality and quantity of required knowledge about environment, the communication module in the proxy receives environment's parameters representing an adaptation request **(1)** from the server. Then, communication module sends to the data base the new environment parameters **(2)**, if the new environment parameter exists in the data base; this last sends the stored adaptation type according to these new environment parameters to the decision module **(4)**. Else the decision module in the proxy selects adaptation type corresponding to the new environment parameters in adaptation type data base if it exists. Else, data base will send only the new environment parameters **(5)** witch represents a negative answer. In this case, decision module creates a new adaptation type(s), sent it (them) to the data base in order to update it **(6)**. Then, decision module send the new environment parameters and the generated adaptation type to the adaptation plan generator **(7)** to get the optimal adaptation plan already stored **(8)**. If the optimal adaptation plan doesn't exist, the registry adaptation generates these set of actions according to the given parameters. Before sending the message to multimedia client receiver **(9)**, adaptation module executes the optimal adaptation plan.

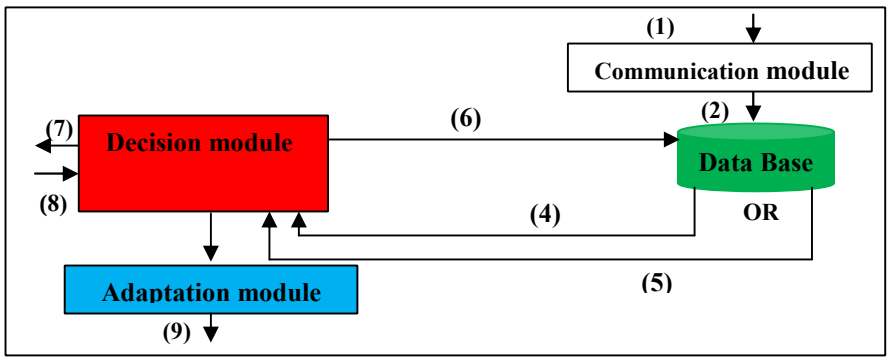

Fig. 2. Functional Schema of the Proxy

Upon receipt of the message, the server sends to the sender multimedia client's mobile phone a confirmation (SMS) message if the message was well received. Otherwise, an error SMS message is sent back to the sender multimedia client's mobile phone.

3.1.4 Adaptation plan generator

The role of the adaptation plan generator is to generate the optimal adaptation plan of the given environment parameter and also to stores all types of adaptation and the set

of adaptation actions of every type. The optimal adaptation generator represents the minimum set of adaptation actions.

4 Study Case

4.1 Mobiles

Each multimedia mobile phone has a specification or a device context. For this reason, we are not able to specify all existing multimedia mobile phones in the market. As study case, we choose to specify dimensions, type, display size, ringtones type, memory card slot, GPRS, HSCSD, EDGE, WLAN, Bluetooth, Infrared port, USB, Supported image format, Supported video format, Supported audio format, Messaging, battery etc of some multimedia mobile phones **[10]**. These specifications are represented in table 3.

Table 3. Specification of four multimedia mobile phones

Technical characteristics	**Nokia 2610**	**Samsung SGH-X640**	**Sony Ericsson K320**	**Nokia N93i**	**Siemens CX65**
Dimensions	104 x 43 x 18 mm	87.4 x 47 x 23 mm	101 x 44 x 18 mm	108 x 58 x 25 mm, 115 cc	132x176
Type	CSTN,65K colors	UFB,65K colors	UBC, 65K colors	TFT, 16M colors	TFT,65K colors
Display size	128 x 128 pixels	128 x 160 pixels	128 x 160 pixels, 1.8 inches	240 x 320 pixels	162x176 pixel
Ringtones type	Polyphonic (24 channels), MP3	Polyphonic (40 channels)	Polyphonic (40 channels), MP3, AAC	Polyphonic(64 channels), MP3	Polyphonic (40 channels)
Memory card slot	No	No	No	miniSD, hot swap	No
GPRS	Yes	Yes	Yes	Class 32, 107.2/64.2 kbps	Class10 (4+1/3+2 slots), 32 - 48 kbps
HSCSD	No	No	Yes	Yes (via PC dial-up)	No
EDGE	No	No	No	Class 32, 296 kbps; DTM Class 11, 236.8 kbps	No
WLAN	No	No	No	Wi-Fi 802.11b/g	No
Bluetooth	No	No	Yes	Yes	No
Infrared port	No	No	Yes	Yes	Yes
Camera to capture image	No	Available	Available	Available	Available
Supported image format	GIF, JPEG, PNG, BMP	BMP, GIF, JPEG, PNG, X-NP-WPNG	GIF, JPEG, WBMP, BMP, PNG, VND.WAP, WBMP, CVG	GIF, JPEG, JP2, JPG, PNG, SVG+WMP, TIFF.	BMP,GIF, PNG,JPEG, SVG,+xml, VND.wap.WB
Camera video	No	No	Available	Available	Available
Supported	No	No	Mpeg, mp4, 3gpp,	3gpp, mp4, vnd.rn-	3gpp

video format			mpeg4, mp4v-es	real video	
Supported audio format	Midi, mid, mp3, x-mid, amr, amr-wb, mpeg, x-amr	Melody, midi	Amr, rhz, midi, x-midi, sp-midi, midi melody, mpeg, mpeg3, mp3,wav, 3gpp, mp4, x-wav, xmf	3pgg, aac, amr,amr-wb, au, basic, mid, midi, mobile-xinf, mp3, mp4, mpeg, rmf, sp-midi, vn d.rm-real audio, wav, x-amr, x-au, x-beatnik-rmf, x-mid, x-midi, x-pn-real audio, x-pn-real audio plugin, x-rmf, x-wav	Midi, wav, amr
Messaging	SMS,MMS, Email, Instant Messaging	SMS, EMS, MMS	SMS, MMS, Email, Instant Messaging	SMS, MMS, Email, Instant Messaging	SMS, MMS, Email
Browser	WAP 2.0/xHTML	WAP 2.0/xHTML	WAP2.0/xHTML, HTML(NetFront)	WAP 2.0/xHTML, HTML	WAP 2.0/xHTML
Battery	Standardbattery Li-Ion 970 mAh (BL-5C)	Standard battery, Li-Ion 800 mAh	Standard battery, Li-Ion 750 mAh (BST-36)	Standard battery, Li-Ion 950 mAh (BL-5F)	Standard, Li-Ion 750 mAh (EBA-660)
Games	Coin Flipping + downloadable,	2 - Snowball fighter, Bubble smile downloadable	Yes	Yes	Yes

Several adaptation techniques have been developed to deliver multimedia data to the multimedia client receiver in heterogeneous environment (heterogeneous mobile phones).Currently available techniques apply textual transformation, image transcoding, video and audio processing. A list of content adaptation technologies that can be applied to the basic media types: text, image, audio and video are presented in **table 4**.

Table 4. Media types and content adaptation techniques [11, 12]

Category	Text	Image	Video	Audio
Transcoding	-format conversion -font size reduction	-data size reduction -dimension reduction -color-depth reduction -color-to-grayscale reduction -format conversion	-frame rate reduction -spatial resolution reduction -temporal resolution reduction -color-depth reduction -format conversion	-audio to stereo-mono reduction - format conversion
Transmoding	-text-to-audio transformation	Image to text	-video-to-image transformation -video-to-text transformation -video-to-audio transformation	-audio-to-text transformation
Summarization	-text summarization		-key frame extraction	-audio highlight
translation	-language translation		-language translation	-language translation

In general sense, content adaptation techniques can be classified as semantic adaptation and physical adaptation. In our study, we are interested in physical adaptation (content level adaptation) techniques as illustrated in section **4.2**.

4.2 Illustrative Scenarios for proposed architecture

Scenario 1: Multimedia client sender is **Nokia 93i** mobile phone and has to transmit an image to another multimedia client receiver **Nokia 2610** mobile phone. The image is stored in colored TIFF format. As specified in table 3, **Nokia 2610** don't use TIFF image format and in addition, dimension of the image is greater than the display screen **Nokia 2610**. So, two transformations are needed: adapt dimension adapt format.
Scenario 2: Multimedia client sender is **Sony Ericsson K320** has to send a video to another multimedia client receiver **Samsung X640**. Multimedia client receiver can't receive this video In this case, it is necessary to get image from the video sequence, convert audio to a text and changing dimension.
Scenario3: multimedia client sender **Siemens CX65** can't receive video stored in mpeg format sent from **Sony Ericsson K320** mobile phone. Consequently, conversion of video format transformation is needed.
Scenario4: The audio stored in .wav format sent by a multimedia client sender **Nokia N93i** needs an audio conversion format to be received by the multimedia client receiver Samsung **SGHX640** multimedia mobile phone.

5 Conclusion

In this article, we have presented the state of the art concerning approaches, multimedia adaptation architecture and a comparative study for each one. We have presented architecture to provide an open system for exchange multimedia data for multimedia mobile. The architecture is based upon the Client/Intermediary/server model, where proxy is as a web services. The aim of the open system is to improve the Qos in exchanging multimedia data over heterogeneous mobile type and to integrate several type of multimedia mobile phone. Our work is in progress, so we'll model data bases essentially descriptors and adaptation type base with UML and implementation with Java language.

References

1. Gioia P., Co DiGiacomo T., Joslin C., Thalmann N., ISIS : Intelligent Services, Acts of the 1 European Conference on Visual Media Production (CVMP), London, England, 15 et 16 Marsh, 2004, p. 295-304.
2. Lemlouma T., Cécile R., Layaida N.: Negotiation and Adaptation Architecture of Multimedia Services in an Heterogeneous Environments, thesis of doctorate, GRENOBLE POLYTECHNIC NATIONAL INSTITUT , France, June 2004.
3. Kazi-Aoul Z.,Dmeure I,Moissinac J C: Architecture for providing adaptable multimedia documents in a pair to pair logic , France, 06 12 2005.
4. Hagos B., Brunie L, Pierson J: Access and adaptation multimedia content for pervasive systems, thesis of doctorate, Lyon, France, 25 September 2006.
5. M.Margaridis and G.C. Poloyzos: Adaptation Technique for Ubiquitous Internet Multimedia. Wireless Communication and Mobile Computing, John Wiley & Sons, 2001, Vol. 1, No. 2, pp.141-164.
6. K. Marriott, B. Meyer, and L. Tardif: Fast and Efficient client-Side Adaptivity for SVG. ACM press, 2002: In proc. Of WWW 20002, Honolulu, Hawaii, USA, May 2002,pp. 496-507.
7. A. Singh, A. Trivedi, K. Ramamritham et al. PTC: Proxies that Transcode and Cache in Heterogeneous Web Client Environments. World Wide Web Journal, 2004 Vol.7. No. 1.DD. 7-28.
8. Hagimont D., Layaïda N: Adaptation of a multimedia application by a mobile code, France, 2002.
9. Kazi-Aoul Z., Demeure I., Moissinac J C.: A generic Architecture for providing adaptable multimedia services - illustration by a scenario, First day's of francophone acts: Mobility and ubiquity, Nice, 1-3 June, 2004.
10. http://www.mobilemultimedia.be/fr/index.php

11. Z. Lei. : Media transcoding for pervasive computing. ACM Press, Vol. 9. In Proceedings of the ninth ACM international conference on Multimedia, 2001, Ottawa, Canada, pp. 459-460. ISBN: 1-58113-394-4.
12. Shanableh T., M. Ghanbari: Heterogeneous video transcoding to lower spatio-temporal resolutions and different encoding formats, IEEE Trans. Multimedia, June 2000, Vol. 2, pp. 101-110.